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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 09/039,438   | 03/16/1998  | WOO-SUP SHIN         | 041992-5037         | 9576             |
| 30827  | 7590        | 03/24/2006           | EXAMINER            |                  |
| MCKENNA LONG & ALDRIDGE LLP<br>1900 K STREET, NW<br>WASHINGTON, DC 20006 |             |                      | ZERVIGON, RUDY      |                  |
|  |             |                      | ART UNIT            | PAPER NUMBER     |

1763

DATE MAILED: 03/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

*W*

|                              |                        |  |                     |  |
|------------------------------|------------------------|--|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> |  | <b>Applicant(s)</b> |  |
|                              | 09/039,438             |  | SHIN ET AL.         |  |
|                              | <b>Examiner</b>        |  | <b>Art Unit</b>     |  |
|                              | Rudy Zervigon          |  | 1763                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 06 January 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. In view of the appeal brief filed on January 6, 2006, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

#### ***Claim Rejections - 35 USC § 103***

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schutt (US 3,532,568 A) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838). Schutt discloses an etching process and apparatus for chemically etching ("etching zone 1"; Sole figure) material from a substrate (copper, abstract). An etched product (iron; column 2, lines 1-

Art Unit: 1763

10) is etched in unit 1 (Applicant's "etch bath") thereby at least contacting the solid with the aqueous liquid (sulfuric acid, HCl; column 1, lines 65-68) and the resulting liquid (3) is passed through an ion exchanger (8) to remove the ions from the rinse liquid which is reused or discharged. The solids are removed from an etcher ("etch bath") via a stream (3) which passes into a rinse chamber (5) including outlet pipe (7). The rinse liquid stream (7) then goes through an ion exchanger means (8, second tank). A replenishing solution (9) from the ion exchange means is combined with the bulk storage tank (11, first tank) going to the etcher (1). The bulk storage tank (11, first tank) has a stream flowing to the etcher (1) for etching the product.

Schutt does not disclose an immersion of a substrate in an etched bath or a bubble plate used therein.

Chung et al disclose a bubble plate (17) located on the floor of a tank (10; Fig. 1). The bubble plate (17) transmits inert gas to create a bubbling condition within the tank (10) for sufficient agitation (col. 1, lines 60-68). Silicon substrates (14; column 3, lines 44-48) are immersed in an etch bath ("hot sulfuric acid"; 13; Fig. 2; col. 2, lines 25-38; column 3, lines 44-48).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to replace the spray etcher of Schutt with the etch bath and bubble plate of Chung et al.

The motivation for doing so would be to replace the etchant delivery means (ie, sparger etcher) with an alternate and equivalent etching means (ie a bath etcher).

Schutt and Chung et al do not teach a temperature sensor and control unit.

Kanda et al disclose a process control system (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) having a thermocouple for measuring the temperature of the etching solution (8, Figure 2; column 9, lines 22-23) used to etch a submerged substrate (2, Figure 3). Kanda

Art Unit: 1763

specifically teaches a control unit (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) for receiving a signal indicating the temperature (T) of the etchant from a temperature sensor (“thermocouple”) and transmitting an etching termination signal (P \_ 0) to the etch bath when the temperature reaches a target temperature. Further, Kanda teaches the etched thickness (Q; column 10, lines 10-15) of the substrate is derived from the temperature (T) of the first etchant. Schutt, Chung, and Kanda do not teach using the total reaction energy as a reference. Schutt, Chung, and Kanda do not teach a controller that controls the first tank, the etch bath and the second tank. Schutt, Chung, and Kanda do not teach using gravity (i.e. weight) for separating the diluted etchant from the residual material.

Allies teaches a controller (340; Figure 3; column 3, lines 55-60) that controls the volume of fluid within numerous process tanks (column 3, lines 58-67), including controlling the temperature of said tank(s) (column 3, lines 58-67) resulting from numerous input signals (column 4, lines 1-10). Allies further teaches teach using gravity (i.e. weight) for separating the etchant ( $\text{CuCl}_2$  etchant – column 3, lines 37-40) from residual material by mass/material filtration in filtration tank 338, Figure 3 – column 5, line 64 - column 6, line 5

At the time of the invention it would have been obvious to a person of ordinary skill in the art to control the etching operation for the etching apparatus of Schutt with the chemical processing control system of Kanda and Allies including using the total reaction energy as a reference by replacing Kanda’s temperature in any of Kanda’s “Q” equations (column 10) with “reaction

Art Unit: 1763

energy” as derived from the well know thermodynamic relationship between molar enthalpy (per unit mass), heat capacity, and temperature<sup>1</sup>:

$$\frac{\partial H}{\partial T} \equiv c_p$$

The motivation for controlling the etching operation for the etching apparatus of Schutt and Chung et al with the chemical processing control system of Kanda and Allies, using “reaction energy”, would have been to detect the termination of etching appropriately and precisely as taught by Kanda (column 10, lines 44-47) by an alternate a equivalent means of detecting said termination in using “reaction energy”.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add Allies’s mass/material separation filtration tank to Schutt’s processing system.

The motivation to add Allies’s mass/material separation filtration tank to Schutt’s processing system is to further purifying the recycled spent etchant solution as taught by Allies (column 5, line 64 - column 6, line 5).

Therefore, it would have been obvious to a person of ordinary skill in the art to combine Schutt with Chung et al and Kanda to obtain the invention.

4. Claims 3-6, 8, 9, 12, 15, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schutt (US 3,532,568 A) in view of Chung et al (U.S.Pat.5,00,795), Kanda (U.S. Pat. No. 4,886,590), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Jones et al (U.S. Pat. No. 3,869,313).

Schutt, Chung, Kanda, and Allies are discussed above.

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<sup>1</sup> As demonstrated (MPEP 2116.01) in Physics for Scientists & Engineers, 2<sup>nd</sup> Ed. R.A. Serway, Saunders College Publishing, 1986. pp. 428 (see top-most equation).

Art Unit: 1763

Schutt, Chung, Kanda, and Allies do not disclose expressly a rinse and drying bath for the substrate.

As to claims 3-5, 8, 9, and 12, Jones et al disclose a chemical processing apparatus containing a plurality of treatment chambers having a dip chamber with filling pumps, a spray chamber which serves as a rinse chamber or a drying chamber (col. 2, lines 20-39 and 63-68; col. 3, lines 1-10). The rinse chamber would be filled with deionized water from a deionized reservoir (col. 2, lines 52-55). An essential part of the apparatus is a conveyor means for automatically transferring the workpieces from treatment chamber to treatment chamber. (Fig. 1; Col. 3, lines 50-55). The conveyor allows for a plurality of substrates to be processed substantially at the same time. Using a pump to move fluid from one chamber to another is conventional. Jones further teaches a controlled heater 67" (column 2, lines 28-35) used in the treatment chamber that may be used as a drying chamber (column 3, lines 1-3).

As to claim 6, Jones et al disclose a cleaning/etching solution containing hydrofluoric acid (col. 5, lines 49-60; col. 6, lines 33-35 and 51-54). Jones et al disclose cone shaped bottom tanks (Figs. 6A-B).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the multiple chambers for rinsing and drying of Jones et al with the etching apparatus of Schutt, Chung et al, and Kanda.

The motivation for doing so would have been to provide treating operations such as rinsing and drying of substrates as taught by Jones et al.

5. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Schutt (US 3,532,568 A) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and

Art Unit: 1763

Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Tittle (USPat. 4,886,590). Schutt, Chung, Kanda, and Allies are discussed above. However, Schutt, Chung, Kanda, and Allies do not teach a concentration measuring device of the first etchant.

Tittle teaches a concentration ("characteristic"; column 1, lines 31-36; column 2, lines 17-22) measuring device ("sensors", "chromatograph"; column 1, lines 65-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Schutt, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his endpoint detection system.

Motivation for Schutt, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his process control system is for monitoring when the rinsing solution should be changed or cleaned (column 1, lines 39-41).

### ***Conclusion***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272-1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (571) 273-8300. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Parviz Hassanzadeh, at (571) 272-1435.

  
  
**PARVIZ HASSANZADEH**  
**SUPERVISORY PATENT EXAMINER**